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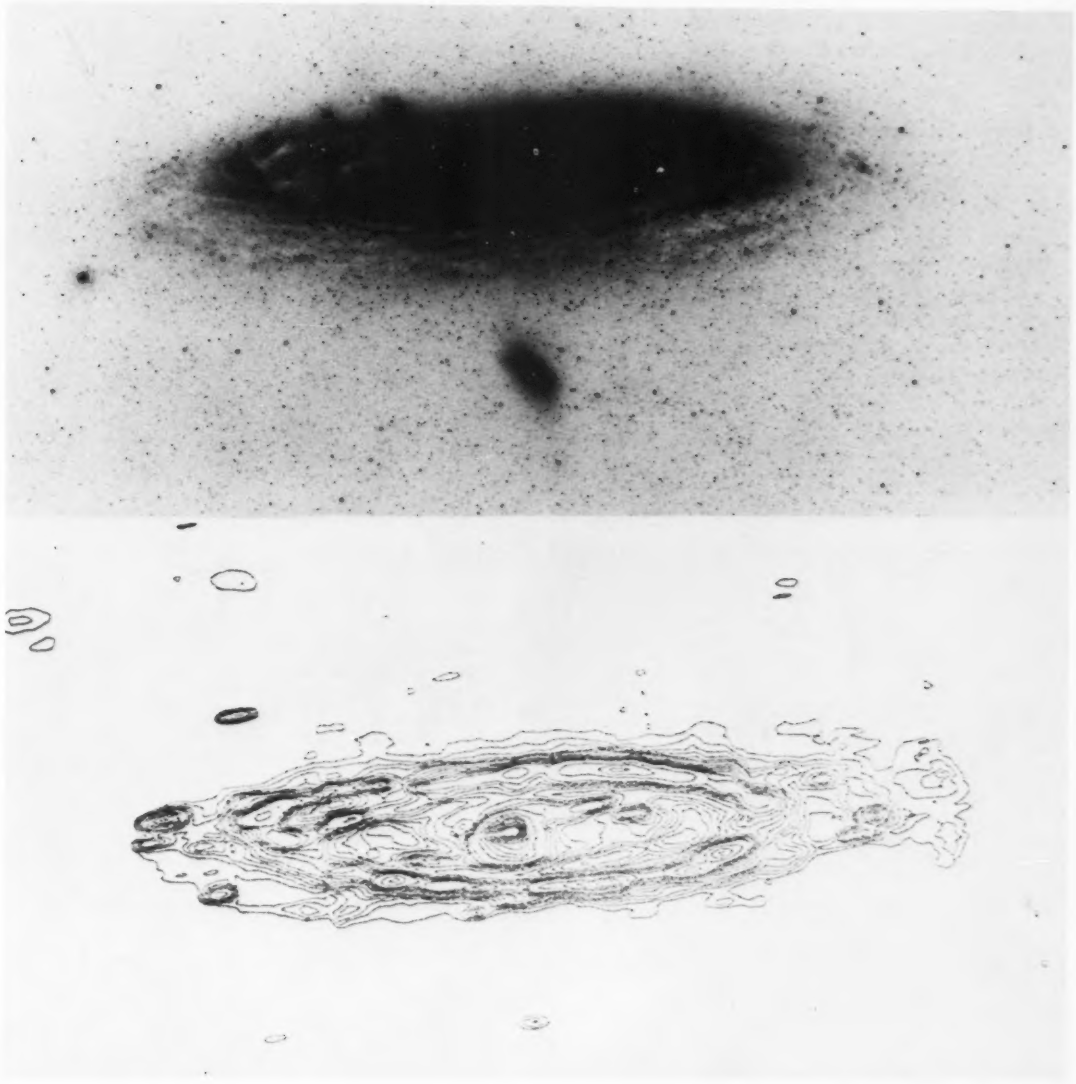

About the Cover

Images show the Andromeda galaxy as seen in visual negative photographs (top) and as seen by the Infrared Astronomical Satellite (IRAS) (bottom). In the visual photo, the stars are dark and dust lanes are light. In the IRAS contour map, which shows infrared emission in the 60-micron wavelength region of the spectrum, Andromeda appears as a flattened ring surrounding the galactic center. The ring corresponds with the dust lane seen in the visual picture. The infrared emission probably comes from dust grains heated by newly formed massive stars. Infrared emission from the galactic center is probably from a small quantity of dust heated by the old stars in the nucleus. Andromeda is approximately 20,000 light years across, and about 2 million light years away. (One light year is 6 trillion miles.) It is the nearest spiral galaxy similar to the Milky Way. IRAS observations of the galaxy represent the first extensive, high sensitivity of Andromeda in infrared wavelengths.

IRAS was launched Jan. 25, 1983. Expected to last only seven months at the time of its launch, the spacecraft scanned the sky for nearly 10 months before ceasing operation in November 1983. IRAS successfully surveyed 95 percent of the sky, pinpointing the locations and intensities of more than 200,000 infrared objects.

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Shuttle Mission 41-C—Pictorial Highlights

Crew ... Robert L. Crippen, Commander
Francis R. Scobee, Pilot
Terry J. Hart, Mission Specialist 1
James D. van Hoften, Mission Specialist 2
George D. Nelson, Mission Specialist 3

Orbiter ..... Challenger (OV–099)

Arrival at Kennedy Space Center for launch preparation (41–B mission landing date) ..... Feb. 11, 1984

Rollover to Vehicle Assembly Building .March 14, 1984

Rollout to launch pad .....March 18, 1984

Launch site ..... Kennedy Space Center; Fla., Pad 39A

Launch date/time ..... April 6, 1984; 8:58 a.m. EST

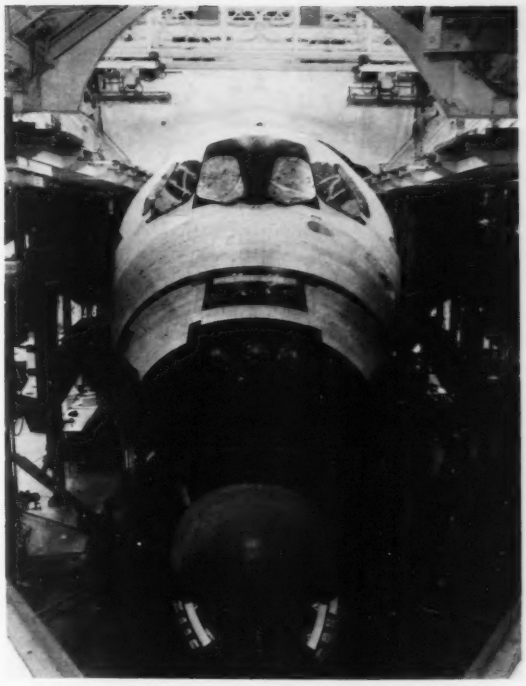
Mission duration ..... 6 days, 23 hours, 40 minutes, 54 seconds

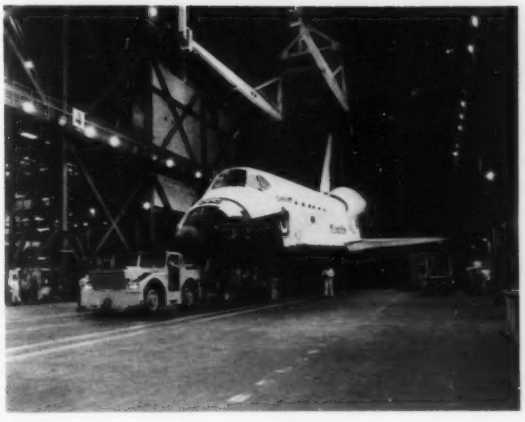
Orbits ..... 107 orbits; landing 108th

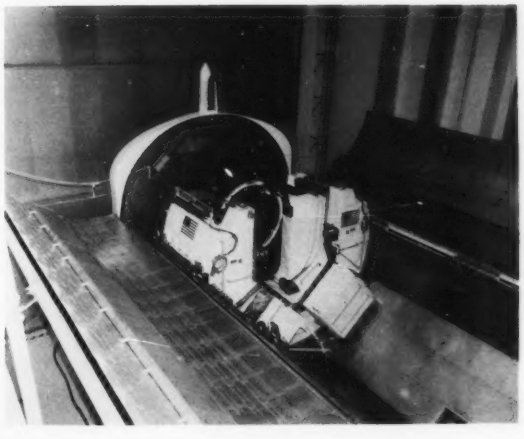
Landing date/time ..... April 13, 1984; 8:38 a.m. EST

Landing site .....Edwards Air Force Base, Calif.

Mission firsts ..... First repair of a satellite in orbit
First direct insertion ascent
First flight of the Long Duration Exposure Facility

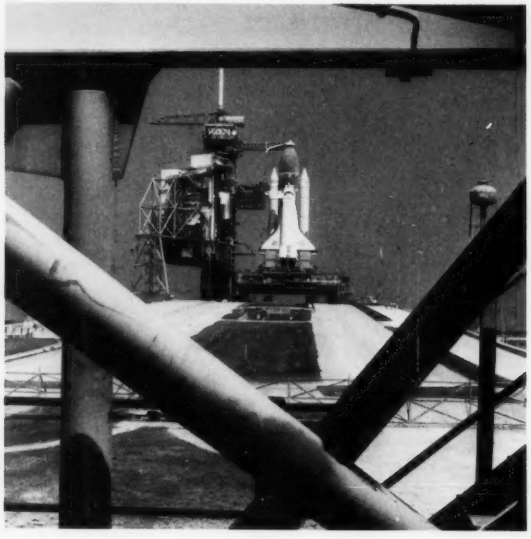


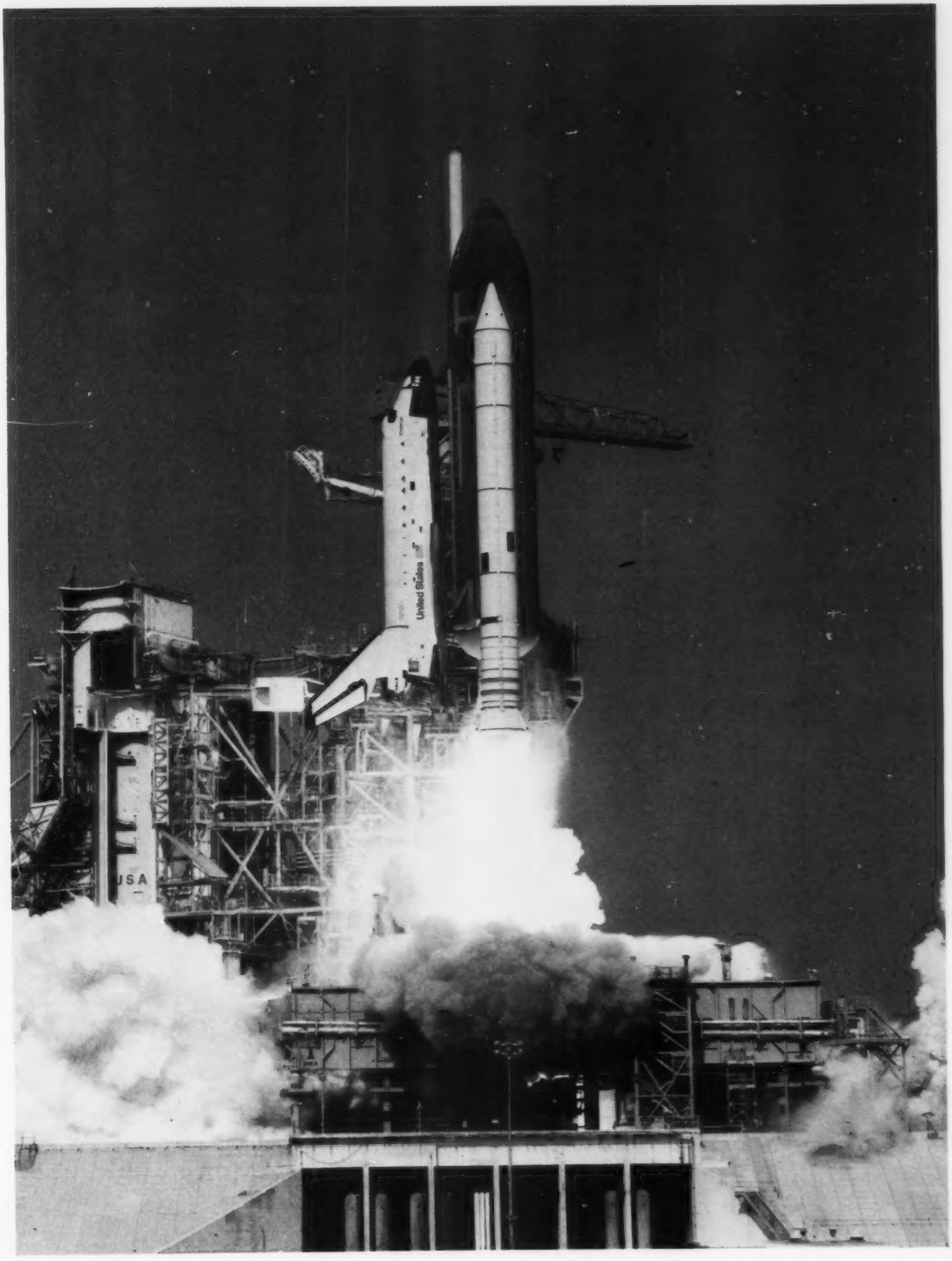




Flight Support Structure and repair equipment positioned in the Payload Canister (lower left); Challenger is backed out of High Bay 2 of the Orbiter Processing Facility for its move to the Vehicle Assembly Building (upper right); the orbiter is towed into the transfer aisle of the VAB in preparation for attachment to the external tank and solid rocket boosters.

Challenger poised on Pad 39A after rollout on April 6 (upper left); honeybees are readied for their trip into space (lower left); crew breakfast (upper right); departure for launch pad (center right); Challenger is seen through the support structure of the crawler transporter (lower right).

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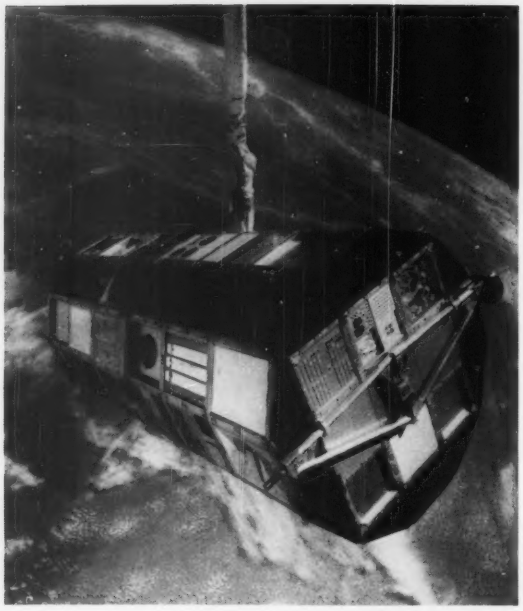
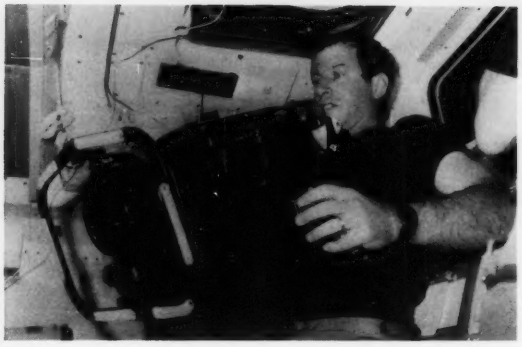
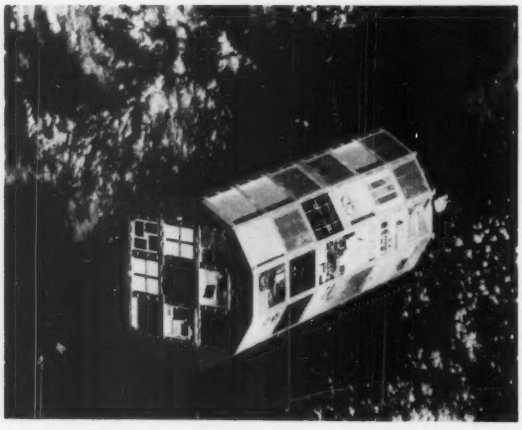
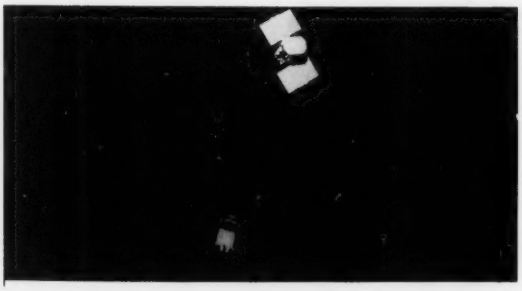
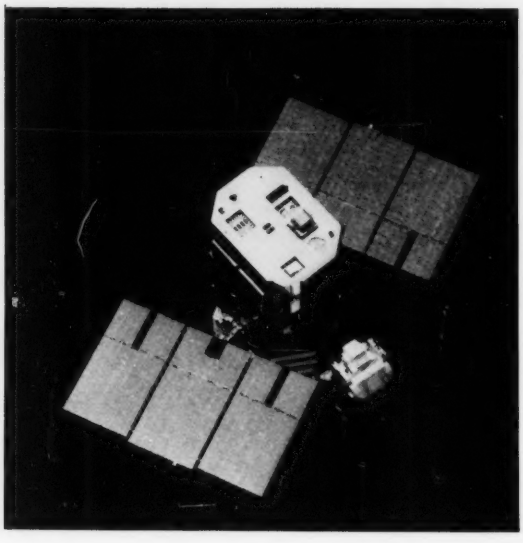


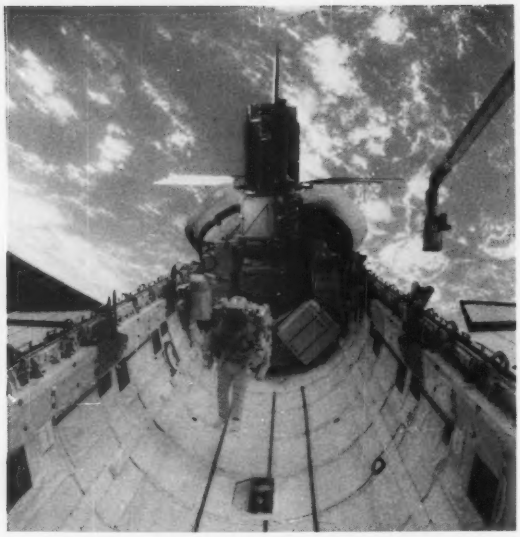


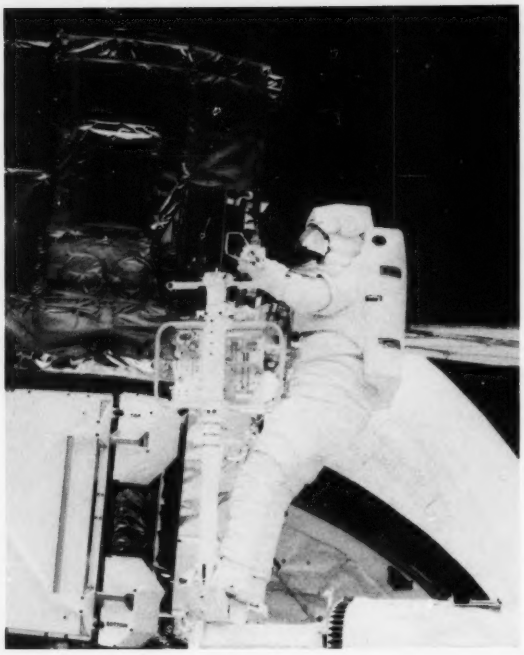
Remote Manipulator Systems suspends the Long Duration Exposure Facility (upper left); LDEF in orbit (center left); van Hoften with honeybees (lower left); Hart holds 70-pound IMAX camera in middeck (upper right); Nelson enroute to Solar Max (center right); rendezvous with the spacecraft (lower right). van Hoften (left) and Nelson share repair task at captured Solar Max in the aft end of the cargo bay (page 8).

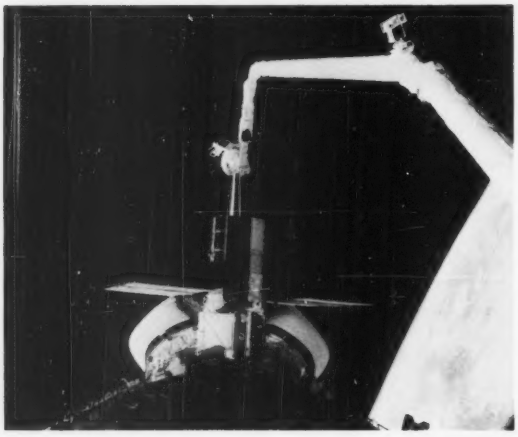


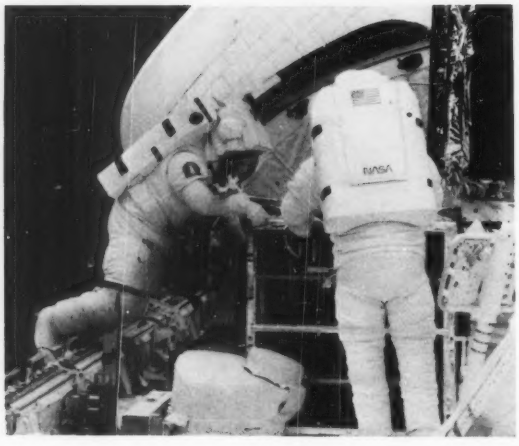




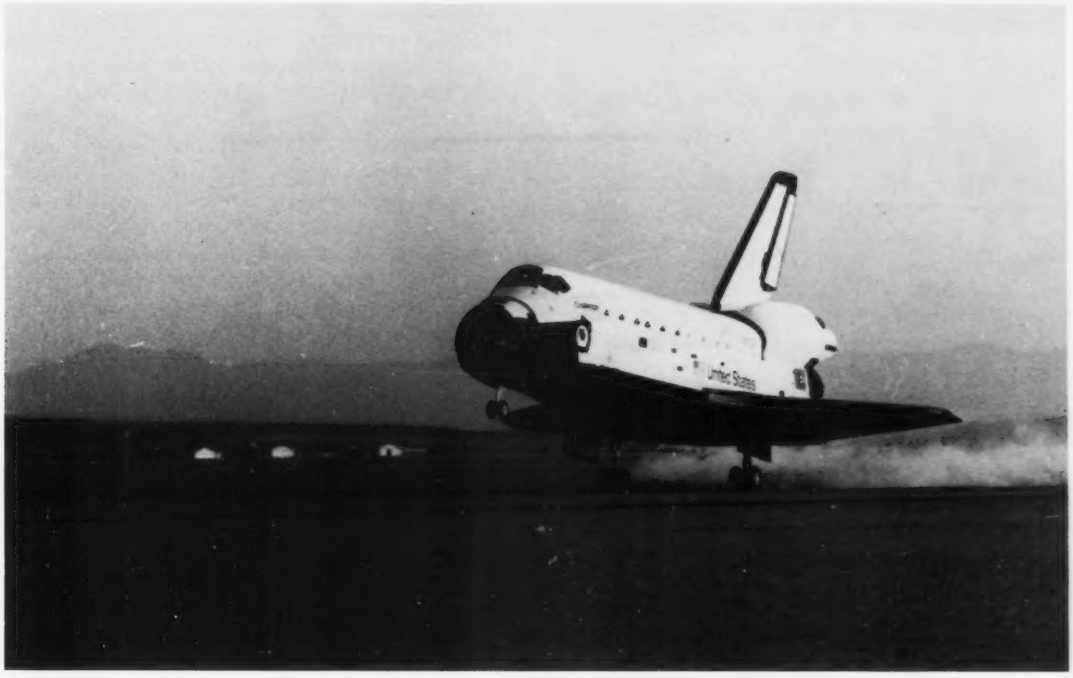




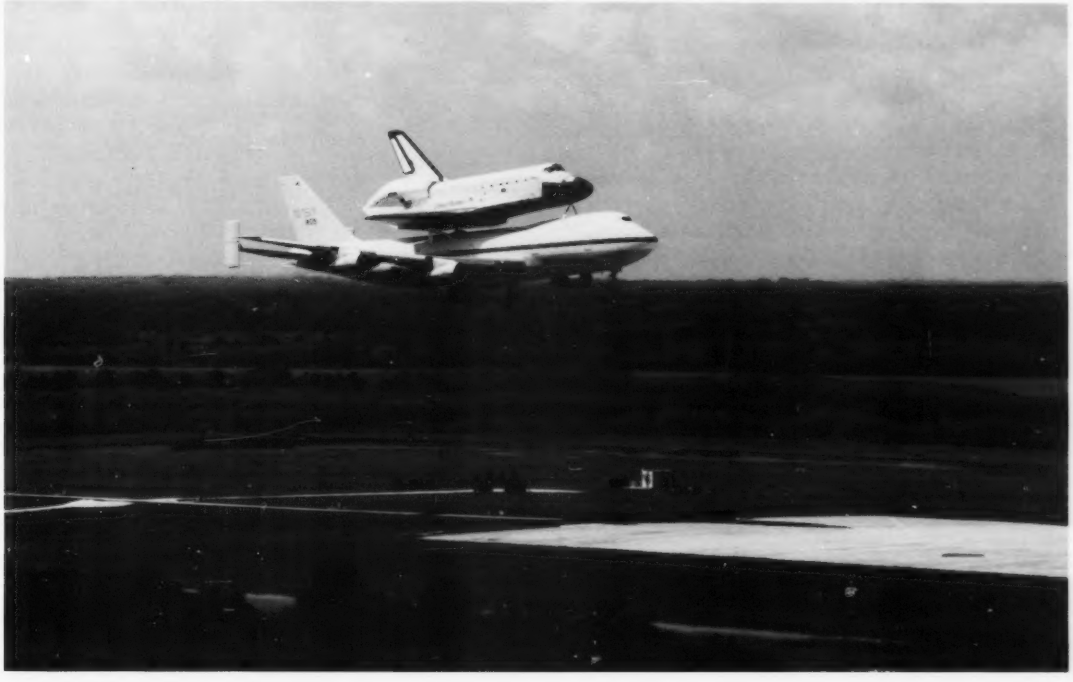




van Hoften caps off a busy day of work (upper left); Remote Manipulator System moves astronaut into position for series of chores (center left); Nelson (left) and van Hoften change faulty attitude control module on SMM (lower left); van Hoften uses power tool to work on Main Electronics box (upper right); "Ace Satellite Repair Co.," (from the left) Scobee, Nelson, van Hoften, Hart and Crippen (lower right).



Touchdown at Edwards Air Force Base, Calif. (top); Challenger, aboard the Shuttle Carrier Aircraft, returns to Kennedy Space Center.



Comet Kopff to be Target for NASA Rendezvous

A NASA scientific advisory group has recommended a relatively bright, active short-period comet named Kopff as the target for a rendezvous by a NASA spacecraft in the first of a series of proposed missions to primitive solar system bodies (comets and asteroids) and the far outer planets.

This mission would use a new planetary spacecraft, the Mariner Mark II, successor to the Mariner, Ranger, Viking and Voyager spacecraft.

The selection of the comet Kopff was made at a meeting at the California Institute of Technology of NASA's Comet Rendezvous Science Working Group, a team of 20 U.S. and European scientists, appointed to advise the space agency on planning for such a mission.

Current plans call for the NASA spacecraft to rendezvous with the comet Kopff in May 1994, after a July 1990 Space Shuttle launch.

A rendezvous mission would differ from a flyby in that the spacecraft would match the comet's orbit around the sun and then stay with the comet for several years. This extended encounter would allow close-up observations under a variety of conditions.

Scientists in the comet working group say they are enthusiastic about NASA's plans for a rendezvous mission as a follow-up to the flybys to be carried out in 1985 by the NASA International Cometary Explorer of the comet Giacobini-Zinner and in 1986 when European, Soviet and Japanese spacecraft encounter Halley's Comet.

The scientists chose Kopff from a list of short-period comets. Longer-period comets generally have orbits that are more difficult to match for rendezvous missions.

Comet Kopff, one of the brighter short-period comets, orbits the sun every 6.5 years. It has been observed by ground-based astronomers and by two spacecraft—the International Ultraviolet Explorer and Infrared Astronomical Satellite—when it was in the inner solar system during the summer of 1983. The data show that Kopff is somewhat dustier than most short-period comets.

The selection of the comet Kopff was based on its relatively active state and because the spacecraft will be able to perform the rendezvous maneuver more than two years before the comet's closest approach to the sun.

The spacecraft will orbit Kopff and study it in great detail from ranges of less than 10 kilometers before the comet becomes active as a result of solar heating. After the comet forms its coma and tail, the spacecraft will back off some distance to continue operation in the dusty near-comet environment.

An additional attraction of the mission to comet Kopff is the opportunity to take close looks at two main belt asteroids named Namaqua and Lucia; flybys of these bodies will take place during the journey out from earth to comet Kopff.

NASA's Jet Propulsion Laboratory, Pasadena, Calif., is conducting systems-development studies for a variety of planetary missions—the deep-space elements of the Core Program of future projects recommended by NASA's Solar System Exploration Committee. These will be carried out during the next two decades and include missions to Saturn, Titan, Uranus and the main belt asteroids, as well as comet Kopff. The Mariner Mark II comet mission is planned for a fiscal 1987 new start.

The payload for the comet Kopff encounter would include scientific instruments mounted on the spacecraft bus or a scan platform, depending on the pointing requirements. The Mariner Mark II spacecraft will utilize electronics and parts from other spacecraft including the Viking, Voyagers, Galileo and the Venus Radar Mapper in order to minimize development costs.

Checkout Complete; Landsat-5 Turned Over to NOAA

Engineers at NASA's Goddard Space Flight Center, Greenbelt, Md., have completed checkout and activation of the Landsat-5 earth resources satellite and turned over operational control of the spacecraft to the National Oceanic and Atmospheric Administration on April 6.

The 4,300 -pound spacecraft was launched from the Vandenberg Air Force Base launch complex in California on March 1 and, through orbit-adjust maneuvers, has been placed in a 438-statute mile near-polar orbit.

Since then, NASA engineers have checked out all computer, communications, telemetry and other spacecraft systems and declared the spacecraft "go" for opeational use. In the 36 days since launch, engineers at Goddard have acquired more than 1,013 images from the Multispectral Scanner instrument on the spacecraft and 646 more scenes from the Thematic Mapper.

Operational control of the spacecraft and of the Multispectral Scanner Ground Processing will be assumed by NOAA in the turnover. However, Goddard experts will continue to manage and operate the Thematic Mapper portion of the ground segment, still in the experimental stage, until January 1985.

Hitchhiker to Carry Payloads of Opportunity Aboard Shuttle

Goddard Space Flight Center has received the go-ahead from NASA Headquarters to build a "hitchhiker" capable of carrying packages aboard the Shuttle that are too small to pay their way as principal payloads but too big to fly as Getaway Specials.

The hitchhiker, properly known Hitchhiker-G (for Goddard) is NASA's new Shuttle Payload of Opportunity Carrier (SPOC). It consists of a series of detachable mounting plates which can be fitted to the side of the Shuttle to carry scientific instruments up to 750 pounds on short notice. The service will be available to NASA and (on a reimbursable basis) to other agencies, private industry and foreign governments.

The new carrier should be ready for its first flight in March 1985 and is expected to fly at least twice a year, according to Ted Goldsmith, SPOC Mission Manager in the Attached Payload Project at Goddard.

Hitchhiker uses room in the Shuttle's cargo bay that goes unfilled by principal payloads during many missions. Currently, the orbiter is equipped to carry up to four full-sized payloads (each averaging 13,000 pounds) for an average cost of $24 million each. Smaller payloads fly aboard the Shuttle in canisters through Goddard's Getaway Special Program (up to 200 pounds for $10,000), or on discipline oriented scientific laboratories having long lead times.

"The hitchhiker represents a tremendous savings in cost and lead time for users now caught in between these capabilities," Goldsmith predicts. The price schedule, which will be appropriately higher than Getaway Specials, is being developed by Headquarters.

Hitchhiker will carry enough avionics to support up to six user payloads. The avionics are attached to the system's 50-by-60-foot key plate. Other plates the same size can be added or subtracted as needed, tying into the first plate's avionics.

Up to 250 pounds of user hardware can be attached to the avionics plate, with supplementary plates carrying an additional 500 pounds each. If the full surface area of a plate is not needed, a user payload up to 750 pounds can be mounted directly to the side of the orbiter through an attach fitting.

For instruments requiring pressurization or protection in the open cargo bay, hitchhiker can provide modified canisters developed by the Getaway Special project. The canisters carry 170 pounds each and have opening lids, allowing their interiors to be exposed to space if desired.

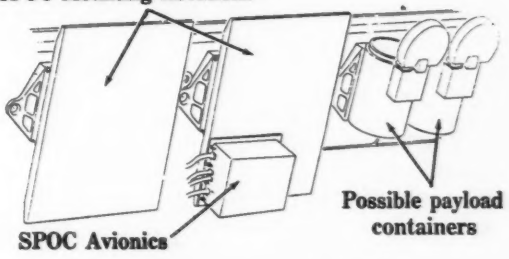
Hitchhiker provides electrical services for user payloads including up to 500 watts of 28-volt power and 1200 baud uplink and downlink communications capability. The communications can be routed directly to a user's ground support equipment for realtime command and data service. Higher data rates up to 50 megabits per second can be arranged as an optional service.

According to Goldsmith, Goddard's current plans call for building the central mounting plate, an additional bare plate and providing for two modified Getaway Special canisters. The first payloads to use the hitchhiker have not been identified, but two future users will be Goddard's own OSS-2 payload and the Multi-Linear Array.

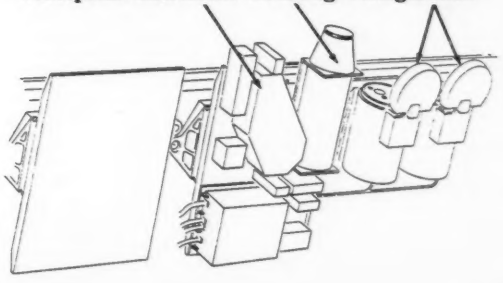
On most future Shuttle flights, there should be room for a hitchhiker. The limiting factor is whether the Shuttle's principal cargoes require the orbiter's full electrical services or crew time. This is most likely to occur when the Shuttle is carrying its full complement of four payloads or is flying a particularly labor intensive mission such as Spacelab.

While Goddard is preparing Hitchhiker-G, Marshall Space Flight Center in Huntsville, Ala., is designing a similar but larger version of the same concept known as Hitchhiker-M (for Marshall). Proposed to carry heavier payloads of opportunity associated with such tasks as materials processing or space manufacturing, Hitchhiker-M would fit across the cargo bay rather than along one side.

SPOC Mounting Locations



Conceptual Instrument Mounting Configuration



NASA Requests Experiments for Tethered Satellite

NASA and its Italian counterpart, the National Space Plan office of the Italian National Research Council (PSN/CNR), have asked scientists from around the world to submit their ideas for experiments to be performed on a joint United States/Italian program known as the Tethered Satellite System—a satellite that later this decade could be reeled into and out of the Space Shuttle's cargo bay on a miles-long tether.

Under the Announcement of Opportunity, scientists have until May 21 to submit a letter of intent to propose an experiment for the system and until July 20 to submit detailed explanations. NASA and PSN/CNR will evaluate the proposals and decide which experiments will be performed on the Tethered Satellite System. The "satellite on a string" will be carried aboard the Shuttle for its first mission by 1987.

NASA will build the deployment system (the tether, reel, control system and related apparatus that will fit into the Shuttle's cargo bay) and Italy will build the satellite itself. NASA will also be responsible for systems integration and mission operations.

The concept of a tethered satellite in space has been under study since the mid-1970s. "Its joint development was proposed to us by the CNR in 1980," said John Sakss of NASA's International Affairs Division in Washington. "We carried out closely coordinated feasibility studies from 1981 through 1983 and defined what each side, using its own capabilities and funds, would do in the joint project." A formal Memorandum of Understanding for the joint project was signed in Rome on March 7, 1984, by NASA Administrator, James M. Beggs, and CNR President, Ernesto Quagliariello.

In orbit, the satellite will be suspended either downward or upward from the Shuttle's cargo bay on a tether, a super-strong synthetic cord about a sixteenth of an inch thick and up to 60 miles in length. When deployed upward, as it will be for its maiden mission in 1987, the satellite will study electrodynamic and other scientific phenomena. Deployed downward, as it will be for later missions, the satellite will troll the earth's upper atmosphere for magnetospheric, atmospheric and gravitational data.

The globe-shaped satellite, approximately one and a half meters (about four and a half feet) in diameter and approximately 500 kilograms (about 1100 pounds) in weight, will have one hemisphere devoted to experiment support such as power and data transmission. The other hemisphere will be allocated to the experiments themselves. In the center of the satellite will be a cold-gas system, with small jets rimming the satellite at the "equatorial plane," the dividing line between its two hemispheres. The cold-gas system will be used for attitude control of the satellite as it sweeps through the upper atmosphere in downward deployment or, in upward deployment, through the space plasma—a region of ionized gas particles surrounding the earth.

On its first flight in 1987 the satellite, once the Shuttle is in orbit, will be deployed upward about 40 feet by an extendable boom. The satellite will be checked out while at the tip of the boom and then released. As it moves upward away from the Shuttle, the reel will unwind until the satellite is at its proper distance for conducting electrodynamic experiments.

As the Shuttle passes through the space plasma, the satellite, with its conducting tether, can become a generator, much as a copper coil moving within a magnet on earth can produce a flow of electricity. By drawing off the energy from the conducting tether and releasing it into space, scientists will be able to study magnetic lines of flux that surround the earth.

"In fact, we'll even be able to simulate some electrodynamic conditions of other planets," said Dr. Noble Stone, project scientist at NASA's Marshall Space Flight Center in Hunstville, Ala. "For instance, one of the moons of Jupiter—Io—has volcanic activity that causes an ionosphere much like the earth's to be formed. This makes Io a conducting body. As Io moves through Jupiter's magnetic field, a current is formed that flows from Io to Jupiter and back. From earth, we have observed bursts of electromagnetic radiation—radio waves, in other words—on Jupiter. We believe that these bursts come from this circular current flow between Io and Jupiter. By deploying the tethered satellite upward, we hope to simulate the conditions between these two bodies. The satellite will act as the conducting moon Io; and earth, with magnetic lines through which the tethered satellite passes, as Jupiter. In just this one example, we can learn more about the nature of electrodynamics as it pertains to our sister planets."

Future missions also call for a downward deployment. In this mode, the tethered satellite fills a need that has long existed in the study of the upper atmosphere. "Currently there are only limited means by which the upper atmosphere, around 60 to 90 miles up, can be studied," said James Sisson, project manager at Marshall. "The upper atmosphere is a fringe area: it's too high for airplanes and balloons to reach, but it's low enough that the orbits of low-altitude satellites decay from the aerodynamic drag after only a few hours." A number of instrument-laden rockets have been used with some limited success, but they pass through the upper

atmosphere for only a few minutes before falling back to earth. "Besides," says Sisson, "these rockets travel primarily up and down, so they provide only a vertical look at one point in the upper atmosphere. The Tethered Satellite System, however, can be pulled through its extremely low, circular orbit—perhaps only 80 miles above the earth—to study the upper atmosphere for days at a time. This will allow scientists to map the global current system known to exist."

The low orbit will allow higher resolution for experiments that map gravity and magnetic fields. The satellite in low orbit can also provide a platform for atmospheric science measurements actually taken "on-site," in the atmosphere itself, rather than by remote instruments.

Other possible applications of the tether system include radiation surveys, radio experiments, ocean topography mapping and sound propagation studies.

New NASA Publication Issued

Long Duration Exposure Facility (LDEF): Mission 1 Experiments, NASA SP-473, has been published by the Scientific and Technical Information Branch and the Langley Research Center. The LDEF contains 57 experiments developed by the United States and eight other countries and was launched on the STS-13 mission in April 1984. It was edited by Lenwood G. Clark, William H. Kinard, David L. Carter, Jr., and James L. Jones, Jr., of the Langley Research Center. Copies may be obtained from the National Technical Information Service, Springfield, VA 22161, for $19.00

NASA NET COORDINATORS MEET—Headquarters and center coordinators of NASA's Employee Teams came together in late February at Asilomar, Calif., to talk about the progress of their pilot programs, the cornerstone of the agency's productivity emphasis. Standing (from the left): Gene Bishop, Kennedy Space Center, Fla.; David Austin, Irwin Schauer, Diana Zeidel, NASA Headquarters, Washington, D.C.; Skippy Cole, Langley Research Center, Hampton, Va.; Ralph Tortorich, Martin Marietta-Michoud Assembly Facility, New Orleans, La.; Harv Hartman, Johnson Space Center, Houston; Sukie Stanley, Larry Colin, Ames Research Center, Mountain View, Calif.; Chris Dreyfus, Martin Marietta-Michoud; Leo Lunine, Jet Propulsion Laboratory, Pasadena, Calif.; and Dale Crossman, Headquarters. Seated: Bill Reynolds, Marshall Space Flight Center, Huntsville, Ala.; Debbie Griest, Lewis Research Center, Cleveland; Joyce Beattie, Headquarters; Marilyn Gist, Goddard Space Flight Center, Greenbelt, Md.; Dennis Cunningham and John Leveen, Ames Research Center.

LANGLEY, HEADQUARTERS SHARE EEO TROPHY—Dr. Harriett Jenkins, Assistant Administrator for Equal Opportunity Programs at NASA Headquarters, presents the Equal Opportunity Trophy to Langley Research Center, Hampton, Va., at a special ceremony in March. Awarded annually to the installation with managerial strategies producing the most positive affirmative action/equal opportunity results, the trophy is shared this year by Langley and NASA Headquarters. With Jenkins is Richard Peterson (left), Langley Deputy Director and chairman of the center's Equal Opportunity Steering Committee, and Donald Hearth, Langley Director.

Contractor News

Ames Research Center, Mountain View, Calif., has leased an advanced super-computer, called the Cray-2, from **Cray Research, Inc.**, of Minneapolis, Minn. Ames will lease the computer for a three-year period beginning in mid-1985. The agreement provides for two additional one-year priced options. The five-year agreement, including maintenance and software, is valued at $44.9 million. The Cray-2, a major component of the Numerical Aerodynamic Simulation capability, a new national effort for supporting advanced research in aerodynamics, will be located at Ames. Cray Research is developing a high speed computing capacity using vector and parallel processing techniques in combination with a very large common memory. The Cray-2 is expected to perform at a sustained rate of 250 million floating point operations per second for optimized programs. Advances in numerical aerodynamic simulation will provide important savings in development time and in cost for missiles and aircraft by reducing the time spent on experimental testing methods for new designs.

Kennedy Space Center, Fla., has awarded **Fairchild Weston Systems, Inc., Data Systems Division,** Sarasota, Fla., a $4,317,000 contract for the launch equipment integration system (LEIS) to be used at

Vandenberg Air Force Base, Calif. The firm fixed contract, awarded March 12, 1984, calls for Fairchild Weston to design, assemble, install and check out the LEIS to be used in the launch control center. The equipment will be built in Sarasota, and delivered and tested by Fairchild Weston at Vandenberg. Work is to be completed by May 1985. The LEIS consists of a remote control 400-channel programmable signal conditioning and pulse-code modulation data acquisition system. This system will provide realtime data to test controllers in the firing room. The information received will indicate the amount of acoustical and environmental stress occurring to the Space Shuttle, flight hardware and pad structures in relation to current operations at the launch pad. The LEIS will also provide support during Space Shuttle quick-response testing, solid rocket booster stacking operations and other launch related activities.

David S. Boland, Inc., Titusville, Fla., has won a $1,776,000 fixed-price contract to prepare a site for new solid rocket booster facilities at Kennedy Space Center. Under the contract, Boland will provide site clearing and utilities installations for a new Solid Rocket Booster Refurbishment Area about two miles south of the Vehicle Assembly Building. The work will include, but not be limited to: clearing of approximately 45 acres of land; constructing paved roads and a spur extension of an existing railroad; installing water and sewage systems; installing underground electrical and communications systems and gaseous nitrogen distribution systems; and installing fences and gates around the site. The work is to be completed within 180 days. The contract is the result of a set-aside for small business firms.

Fairchild Industries, Germantown, Md.; **RCA Corp.,** Princeton, N.J.; **Rockwell International,** Downey, Calif., have each been awarded a $1 million eight-month contract to conduct satellite definition studies for TOPEX, an oceanographic satellite mission proposed by NASA. Fairchild's Muiltimission Modular Spacecraft (MMS), RCA's Advanced Tiros N (ATN) satellite, and Rockwell's Global Positioning System (GPS) satellite are all candidate designs for the TOPEX spacecraft. TOPEX will provide at least three years of detailed ocean topography information for determining global ocean circulation. The mission is being planned by NASA's Jet Propulsion Laboratory, Pasadena, Calif., for launch in 1989. As a cost-saving measure, the TOPEX spacecraft will be based on an existing satellite design, rather than built as a new and unique spacecraft.

Based on common interest in using radar altimetry to study the oceans from space and a long history of mutually beneficial cooperative projects, NASA and the French Space Agency (Centre National d'Etudes Spatiales) have explored how they might conduct a joint ocean circulation and subsequent science investigations. NASA is therefore studying two options for the project: a collaborative U.S./French mission, called TOPEX/Poseidon; and a U.S.-only mission. Each contractor shall study two satellite configurations for TOPEX, one for each option. The U.S.-only configuration will be designed for launch from the Space Shuttle, while the U.S.-French configuration will be designed for launch from France's Ariane 4 launch vehicle.

Lewis Research Center, Cleveland, has awarded a $161 million contract to **General Dynamics Corp., Convair Div.,** San Diego, Calif., for two Shuttle/Centaur G vehicles for the Department of Defense. This contract finalizes a previous letter contract award and brings the estimated target value of the total contract to $414 million. The original contract called for design, development, testing and engineering, with developmental costs being shared by NASA and DOD. The original contract included two NASA-unique Shuttle Centaur G-Prime vehicles for the Galileo (Jupiter) and International Solar/Polar missions, scheduled for launch in 1986. The finalized total contract is a cost-plus-incentive-fee/award-fee type and will run through December 1986. Most of the work will be performed at the contractor's plant in San Diego, with a smaller portion to be done at the Eastern Space and Missile Center, Fla. Centaur is a high-energy upper stage booster expected to add substantially to the Space Shuttle's ability to deliver heavier payloads from low earth orbit to geosynchronous or interplanetary trajectories.

Marshall Space Flight Center, Huntsville, Ala., has awarded **Rocketdyne Division of Rockwell International Corp.,** Canoga Park, Calif., a $246.1 million supplemental contract modification for work related to the Space Shuttle main engines. The contract, signed March 30, encompasses the fabrication, inspection, test and delivery of nine main engines, and is a follow-on to NASA's original contract with Rocketdyne that went into effect in 1972. The three main engines of the Shuttle thrust the orbiter into space. The engines are assisted in lifting the Shuttle to orbit by two solid rocket boosters attached to the sides.

Marshall has also awarded a $222.8 million follow-on contract to **United Space Boosters, Inc.,** of Huntsville, Ala., for work related to the Space Shuttle solid rocket boosters. Signed March 30, the contract calls for the manufacture, refurbishment, assembly and checkout of the boosters for Shuttle flights 17 through 37. The agreement is a follow-on to NASA's original contract

with USBI that went into effect in 1976. The contract does not include the solid rocket motors, which are under separate contract to **Morton Thiokol, Inc.** Two boosters are used to provide additional thrust during each Shuttle liftoff. After their propellant is spent, the boosters separate from the Shuttle and descend into the ocean on parachutes. The boosters are then recovered and refurbished for use on future Shuttle flights.

NASA Aided Inventor of Programmable Medication System

Robert E. Fischell, inventor of a programmable implantable medication system, which was codeveloped and cofunded by NASA, has been named Inventor of the Year for 1983 by the Intellectual Property Owners, Inc., a nonprofit trade association of holders of patents, trademarks and copyrights.

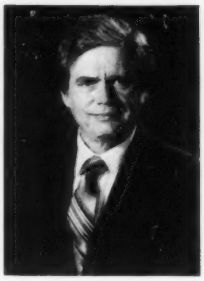
NASA's Goddard Space Flight Center, Greenbelt, Md., and several commercial firms were involved in this new system, which may drastically alter procedures for administering medication. The system may be used to administer insulin to diabetics, provide pain reducing drugs to cancer patients and holds promise for other therapies.

The system uses a progammable computer, implanted in the human body, to dispense medications. Its key element is encased in a package about the size of a woman's compact. It contains a reservoir of medication, a tiny pump, a microminiaturized electronic system and a tube leading to the target area of the body.

The other major element is the Medication Programming System in the physician's office. Programming is accomplished by wireless telemetry—a space technology—in which command signals are sent to the device by a transmitting antenna.

The system is one of several implantable devices developed by Goddard, the Johns Hoplins University Applied Physics Laboratory, Laurel, Md., and other groups over the past decade. Goddard has provided program management and technical expertise in these projects.

Awards Corner



James C. Young, an aerospace engineer in the Space Systems Division at Langley Research Center, Hampton, Va., has received the 1984 Ground Testing Award presented by the American Institute of Aeronautics and Astronautics. The award was presented to Young at the 13th Aerodynamic Testing Conference in San Diego, Calif., "in recognition of singularly outstanding contributions to the wind tunnel testing and aerodynamic design of the Space Shuttle. His technical and managerial contributions have been vital to the Shuttle's success from concept through flight." Young's contributions toward the aerodynamic design, development and testing of the Space Shuttle were made while he was manager of the Shuttle Aerodynamics Subsystem at the Johnson Space Center in Houston. The award is presented annually for outstanding achievement in the development of effective utilization of technology, procedures, facilities, or modeling techniques for flight simulation, space simulation, propulsion testing, aerodynamic testing, or other ground testing associated with aeronautics and astronautics.

Cecil C. Rosen III, Acting Director of the Aerospace Research Division in the goffice Aeronautics and Space Technology at NASA Headquarters, received the 1983 Arthur S. Flemming Award. The award was presented in April at the 36th annual ceremony in Washington, D.C. Sponsored by the Downtown Jaycees of Washington, D.C., it is presented each year honoring 10 of the nation's outstanding young men and women in the Federal government. Rosen was recognized "for his exceptional achievements in research and technology activities both as an engineer conducting aeronautical propulsion research and as a technical manager of research in all aerospace disciplines."

Space Station Appointments Announced at Johnson Center

Neil B. Hutchinson has been named manager of the Space Station Program office at NASA's Johnson Space Center in Houston.

Deputy manager is John W. Aaron. Both appointments are effective immediately.

NASA Administrator James M. Beggs announced in February that Johnson Space Center would be "lead center" for the agency's Space Station program.

Hutchinson has been serving in a staff assignment to the Johnson Director since his return in January 1984 from a one-year assignment at NASA Headquarters, where he was Director, Space Shuttle Operations Office in the Office of Space Flight.

Hutchinson joined NASA in 1962 and worked on the design and development of the Mission Control Center's Real Time Computer Complex. He served as a flight controller on Gemini and Apollo missions before becoming a Flight Director in 1972. He served as Flight Director for the final Apollo lunar landing mission, Apollo 17; for all three manned Skylab missions in 1973-1974; for the Apollo-Soyuz Test Project in 1975; and for Shuttle developmental and orbital flight tests from 1978 to 1981.

In addition to his flight control and flight director responsibilities, Hutchinson served as head of the Systems Logic and Processing Section, assistant chief of the Apollo Command and Service Module Systems Branch, chief of the Guidance and Propulsion Systems Branch and deputy chief of the Flight Integration Office at Johnson.

Aaron has been chief of the Spacecraft Software Division at Johnson since 1981. He also served as Avionics Flight Software Project manager for the Shuttle Approach and Landing Test and Orbital Flight Test programs; as technical assistant to the chief, Spacecraft Software Division and as section head for the Electrical Power, Sequential and Instrumentation Systems for the Apollo Command and Service Module.

In addition to his organizational responsibilities, Aaron also served as a flight controller responsible for vehicle systems operation on Gemini, Apollo and Skylab programs.

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces the following U.S. patents have been issued by the U.S. Patent Office and Trademark Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) & Employer	Title	Patent No.	Installation
Thomas J. Dunn, NASA/JSC	Prestressed thermal protection systems	4,439,968	JSC
Charles F. Coe, Gilbert T. Parra, NASA/ARC	Electronic scanning pressure measuring system and transducer package	4,442,716	ARC
Leslie E. Compton, Caltech/JPL, Pasadena, Calif.	Supercritical solvent coal extraction	4,443,321	NRO/JPL
Mathias B. Handlykken, Caltech/JPL, Pasadena, Calif.	Shaft transducer having DC output proportional to angular velocity	4,443,724	NRO-JPL
Gary C. Bailey, Caltech/JPL, Pasadena, Calif.	Integrating in detector imaging systems	4,443,701	NRO-JPL
Peter O. Minott, NASA/GSFC	Dual aperture multispectral Schmidt objective	4,444,464	GSFC
Terry L. St.Clair, Harold D. Burks, NASA/LaRC	Polyphenylene ethers with imide linking groups	4,444,979	LaRC
Ralph E. Taylor, James W. Sennott, Howard University, Washington, D.C.	Navigation system and method	4,445,118	GSFC
Harry R. Allcock, Angelo G. Scopelianos, Pennsylvania State University, University Park, Pa.	Carboranylmethylene-substituted phosphazenes and polymers thereof	4,444,972	ARC
Dana G. Andrews, Boeing Commercial Airplane Co., Seattle, Wash.	Slotted variable camber flap	4,444,368	LaRC

NASA's Goddard Space Flight Center, located 10 miles northeast of Washington, D.C., in Greenbelt, Md., celebrated its 25th anniversary on May 1. Named for Dr. Robert H. Goddard, "father of American rocketry," the center was established in 1959. Since its inception, the center has built a network for tracking and communicating with near-earth orbiting satellites, developed the Delta launch vehicle for launching medium-sized spacecraft, and become a highly diverse facility with significant responsibilities in all areas of space exploration, including the Space Shuttle. Groundbreaking for the center's Building 1 was June 3, 1959 (upper right); below, Goddard's modern, campus-like complex situated on about 1,000 acres of the rolling hills of Maryland. In addition to the Greenbelt installation, Goddard manages the Wallops Flight Facility, Wallops Island, Va.; the Goddard Institute for Space Studies in New York City; a balloon-launching facility at Palestine, Texas; and 16 tracking stations around the world.

1984 Launch Activity

Space Shuttle Launches

Date	Mission	Orbiter	Launch Site[1]	Remarks
Feb. 3				
April 6	41-C	Challenger (OV-099)	KSC	Payload: Solar Maximum Repair Mission; Long Duration Exposure Facility; successful launch; landing at Edwards AFB, April 13.
June 19	41-D	Discovery (OV-103)	KSC	Payload: Syncom IV-1, Large Format Camera, OAST-1; first flight of Discovery.
Aug. 9	41-F	Discovery (OV-103)	KSC	Payload: Telstar 3-C, SBS-D, Syncom IV-2, SPARTAN-1
Aug. 30	41-G	Columbia (OV-102)	KSC	Payload: OSTA-3, ERBS, SPARX-1
Sept. 28	41-H	Challenger (OV-099)	KSC	Payload: DOD mission or TDRS-B
Oct. 24	51-A	Discovery (OV-103)	KSC	Payload: MLS-1, Telesat-H, GAS Bridge
Nov. 21	51-B	Challenger (OV-099)	KSC	Payload: Spacelab 3
Dec. 17	51-C	Discovery (OV-103)	KSC	Payload: TDRS-B or TDRS-C, MSL-2

Satellite Deployments from the Shuttle

Date	Satellite	Deployment Device/[2] Upper Stage	Shuttle Mission	Remarks
Feb. 3	Wester-VI	PAM-D	41-B	Western Union communications; successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit.
Feb. 6	Palapa B-1	PAM-D	41-B	Indonesia communications; successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit.
April 7	LDEF	RMS	41-C	Long Duration Exposure Facility; successful deployment.
June 20	Syncom IV-1	UUS	41-D	Hughes communications
Aug. 9	SBS-D	PAM-D	41-F	Satellite Business Systems commercial communications
Aug. 10	Syncom IV-2	UUS	41-F	Hughes communications
Aug. 11	Telstar 3-C	PAM-D	41-F	AT&T communications
Aug. 30	ERBS	RMS	41-C	Earth Radiation Budget Satellite
Sept. 28	TDRS-B(?)	IUS	41-H	NASA communications
Oct. 24	Telesat-H	PAM-D	51-A	Canadian communications
Dec. 17	TDRS B or C	IUS	51-C	NASA communications

Expendable Launches

Date	Mission	Launch Vehicle	Launch Site	Remarks
March 1	Landsat 5	Delta	WSMC	National Oceanic and Atmospheric Administration; earth observation; successful launch.
June 7	Intelsat V-G	Atlas Centaur	ESMC	Intelsat international communications
August	NOAA-F	Atlas-F	WSMC	National Oceanic and Atmospheric Administration weather satellite
August	Intelsat VA-A	Atlas Centaur	ESMC	Intelsat international communications
Aug. 2	AMPTE	Delta	ESMC	Active Magnetospheric Particle Tracer Explorer; space physics—NASA cooperative with Germany
September	NATO-IIID	Delta	ESMC	North Atlantic Treaty Organization communications
November	Intelsat VA-C	Atlas Centaur	ESMC	Intelsat international communications
December	San Marco D/L	Scout	SMR	International cooperative with Italy
4th Qtr.	AF-16 (ITV-1)	Scout	WFF	U.S. Air Force

[1] **Launch Sites:** ESMC—Eastern Space and Missile Center, Fla.; KSC—Kennedy Space Center, Fla.; SMR—San Marco Range, Indian Ocean; WFF—Wallops Flight Facility, Wallops Island, Va.; WSMC—Western Space and Missile Center, Vandenberg Air Force Base, Calif.

[2] **Separation Device/Upper Stage:** IUS—Inertial Upper Stage; PAM-D—Payload Assist Module; RMS—Remote Manipulator System; UUS—Unique Upper Stage

Another Dividend from Air and Space

NASA
National Aeronautics and Space Administration

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

High Intensity Lights

During the Apollo program, NASA found a need to develop special high intensity lights to simulate the effect of sunlight on the spacecraft and its occupants. Johnson Space Center, Houston, Texas, developed xenon arc lamps for use as solar simulators in the center's environmental test chamber. The light spectrum of the xenon beam is as close to sunlight as any substitute yet devised. This technology served as the basis for a family of commercial lights developed by Streamlight, Inc., Norristown, Pa.

Shown below is the company's Streamlite™ SL-15 flashlight and its wall-mounted plug-in recharger. The SL-15 is one of four types of rechargeable flashlights featuring computer-focused quartz-halogen lamps with light intensities ranging from 15,000 to 35,000 candlepower. Streamlight also produces several other types of flashlights and emergency handlights for home and professional use.

Top of the line (upper right) is the Streamlite 1 Million which uses a xenon arc lamp to project one million candlepower, the brightest portable light made. Used primarily by law enforcement agencies and the military services, Streamlite 1 Million

throws a light some 50 times brighter than the high beam headlights of an automobile. It can project a narrow beam of pure white light more than a mile; as a signal, its light can be seen for more than 30 miles. Its high intensity beam is especially useful in penetrating fog and smoke because it returns less back-scatter light. The Streamlite 1 Million operates on a 12-volt rechargeable portable power pack or on any 12-volt auto or boat battery.

There is also an infrared model of the 1 Million, called Streamlite Plus, which produces totally invisible light for certain military or law enforcement covert surveillance applications. The light output becomes visible to the user by means of infrared decoders.

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* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.

™ Streamlite is a trademark of Streamlight, Inc.